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ABSTRACT

Mastery motivation, usually measured by task persistence, is often used to predict infant competence. This study attempted to clarify how a measure of persistence can be used to facilitate the prediction of competence when examining the relationship between persistence and maternal child-rearing behavior. The measure of persistence used in this study incorporated several qualitative aspects of persistence, such as multiple problem solving strategies. When they were approximately 18 months old, 31 children were videotaped while they performed various problem-solving and exploratory tasks. Children's problem solving was rated on scales that measured persistence, affect, and task performance. Children also completed the Bayley Scales of Mental and Motor Development. The HOME Inventory was used to rate aspects of the child-rearing environment. Results indicated that persistence was related to aspects of the child-rearing environment; levels of persistence were related to total scores on the HOME inventory. Results suggested that persistence best facilitates competence when a task is very difficult or challenging for a child, and that qualitative aspects of persistence have a stronger association with aspects of the child-rearing environment than do quantitative aspects such as attention span. (MM)

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Reconceptualizing The Measurement Of Persistence In An Attempt To Facilitate Prediction Of Infant Problem-Solving Competence.

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Abstract

Mastery Motivation, usually measured by task persistence, is often used to predict infant competence. This study extended the operational definition of persistence beyond "duration of task directed behaviors", and looked at the relationship between maternal child-rearing practices, persistence, and problem-solving competence. Thirty-one Caucasian boys and girls, with an average age of 17 months, were videotaped as they were tested on the Bayley Mental Scales. Results of the task persistence ratings regressed on CMDI and individual item scores, suggest that persistence best facilitates competence when a task is very difficult or challenging for a child. Maternal child-rearing practices show the strongest relationship with qualitative (e.g. multiple problem-solving strategies), rather than quantitative, measures of persistence.

Introduction

It has long been recognized that scores on infant intelligence tests are not adequate predictors of later competence (Jennings, Yarrow, & Martin, 1984). Even infant success or failure at mastery tasks (e.g., problem solving tasks such as a barrier box) does not predict later ability on either mastery tasks or on measures of intelligence and competence (Messer, McCarthy, McQuiston, Macturk, Yarrow, & Vietze, 1986). In light of these difficulties, as well as the growing recognition of the importance of active exploration of the environment for a child's growing cognitive capacities, researchers have begun to focus less on infant performance and more on infant motivation to master the environment (Caruso, 1990). These studies have demonstrated that the examination of motivation as a process (as distinguished from success or failure), provides a better predictor of later competence on both mastery tasks and on measures of intelligence than prior measures of competence (Messer, Rachford, McCarthy, & Yarrow, 1987; Caruso, 1990).

Mastery Motivation can be defined as a "system which serves the function of instigating and maintaining the behaviors which promote learning" (MacTurk, McCarthy, Vietze, & Yarrow, 1987). The system is best characterized as the "interface between cognition and personality.... it is a striving for competence" (Yarrow, MacTurk, Vietze, McCarthy, Klein, & McQuiston, 1984). In many of these studies persistence, usually defined as "the duration of task directed behavior in problem solving tasks" (Redding, Morgan, & Harmon, 1988), is used as an indicator of mastery motivation. Unfortunately, while these studies have found strong evidence that persistence is a better predictor of current competence than past performance, these same studies have had only limited success in predicting future competence. (For example, see Sigman, Cohen, Beckwith, & Topinka, 1987; Caruso, 1990.)

Study Overview

The current study was designed to address some of the potential problems encountered in earlier studies which may be associated with using persistence as an indicator of mastery motivation. The measure of persistence used in this study incorporates a variety of qualitative aspects of persistence (e.g., multiple problem solving strategies). This study also takes into account the importance of maternal behavior in determining infant mastery motivation and problem-solving skills. (See: Yarrow, Morgan, Jennings, Harmon, & Gaitor, 1983; Wachs, 1987). The goal of the study is to examine the relationship between persistence and maternal child-rearing behavior in an attempt to clarify how a measure of persistence can be used to facilitate the prediction of competence.

Methods

Subjects

The subjects were 31 children (55% girls, 54% pre-term at birth) with an average age of 17 months (range 16-21 months). The subjects are part of a larger, longitudinal, study of children at biological and social risk. Subjects were excluded if they had known physical handicaps. The parents were classified as either working class poor or welfare recipients and the mothers had no more than a high school education.

Procedures

The study assessed the children at the ages of five, eighteen, and thirty months. The assessments took place in the child's home and in the university laboratory. The persistence ratings were made from videotapes taken during the eighteen month assessment in the Cornell Child Study Lab. The problem solving tasks and developmental assessments were made by one of the two principle investigators. The subjects were randomly assigned to one of two conditions;
(a) exploratory tasks followed by the Bayley and then the problem solving tasks, or
(b) problem solving tasks followed by the Bayley and then the exploratory tasks.

Measures

(1) The Bayley Scales of Mental and Motor Development (Bayley, 1969). Five of the individual IBR temperament ratings (Object Orientation, Novelty of Object Orientation, Goal Directedness, Attention, and Endurance) were also included in the analyses. These five IBR temperament items were selected because they represent persistence and/or are the aspects of persistence typically assessed in the mastery motivation literature.

(2) The HOME Inventory (Caldwell & Bradley, 1984) was used to rate different aspects of the child-rearing environment (e.g., Warmth and Acceptance). The HOME is a combination of behavior based observation of the mother and child and mother interview. (Note: the HOME inventory was conducted at the time of the eighteen month assessment during the home visit segment of the assessment).

(3) A five point Persistence rating scale with a score of "1" representing low persistence and a "5" representing high persistence. Low persistence is demonstrated by avoidance of challenge, poor attention span, little or no task directed behaviors, low tolerance for frustration, and refusal to do more than minimally interact with the objects of the task. Medium levels of persistence are demonstrated by giving up easily after the first failure, quickly demanding help, adoption of single strategies for solution, finding only the standard uses and functions of objects, and distractibility. High levels of persistence are demonstrated by goal directed and task oriented behaviors, a desire to work independently, finding creative or novel solutions or functions, adoption of multiple strategies for solution, and the ability to incorporate information from the environment to facilitate solution or exploration.

(4) A six point Affect scale with a "1" representing the most negative affect and a "6" representing the most positive affect.

(5) A separate six point Performance scale with a "1" representing "no solution" and a "6" representing "immediate solution". If a child received a 6 on performance, no persistence rating was made for that problem solving task.

Results

The focus of the persistence, affect, and performance ratings was on three of the Bayley tasks (peg board, pink form board, and blue form board). Because each task is presented twice during the administration of the Bayley, there were two persistence ratings made for each of the three tasks, and the average score from the two presentations was taken. The child's overall persistence score was the sum of all three task persistence ratings. Each child's persistence score was correlated with her score on the criterion tasks and with her scores on two sets of Bayley non-criterion tasks (five problem-solving and three non problem-solving tasks). The rational behind this comparison was that if persistence was a factor underlying a child's ability to solve problems, and was not just an artifact measure of performance on the rated tasks, it should also be moderately correlated with other tasks from the Bayley which were not rated for persistence. Scores on the Bayley Criterion tasks and the two sets of non-criterion Bayley tasks were given in terms of the age in months at which the child passed the task. If the child failed at her age level, the child was given a baseline score (the age at which 5% of children fail the task).

Results indicate that none of the background variables (test age, gestation age, sex, or parent education) were significantly related to persistence. The average persistence score was 10.9 (range 5-15). The average score for affect was 3.8 (range 1-6). On the affect scale, a score of four describes a child who "is basically neutral about the task". Because there was almost no variation in the sample on the affect rating, affect was dropped from subsequent analyses.

The persistence rating is significantly related to performance on the three Bayley criterion tasks and the CMDI, but is unrelated to either set of non-criterion tasks (See Table 1). Of the three criterion tasks, only the pink form board is strongly associated with CMDI scores, and the two sets of non-criterion tasks do not appear to carry much weight in determining the CMDI (See Table 1). Persistence is not related to any of the IBR temperament items or to their composite score. The composite and individual IBR items are also unrelated to the three criterion tasks or to the CMDI (See Table 1).

Persistence is the only measure, other than the CMDI, which is consistently related to aspects of the child-rearing environment. Higher levels of persistence are related to higher total HOME scores and to higher scores on the Verbal Responsiveness, Avoidance of Punishment, Provision of Play Materials, and Stimulation subscales (See Table 2).

The unique contribution of persistence to the CMDI was tested in a series of regression models which controlled for both the overall contribution of the three criterion tasks (SCORE) and the total HOME score. The results demonstrate that SCORE alone accounts for 36% of the variance ($p<.01$) in the CMDI scores. The addition of HOME results in a highly significant 17% increase in the variance ($p<.01$) of the CMDI scores accounted for by SCORE. The addition of Persistence to this model results in a non-significant increase of 2% in the variance of CMDI scores accounted for by SCORE and HOME. (See Table 3.)

The unique contribution of persistence to CMDI scores was also tested in three separate regression models which controlled for the contribution of each individual criterion task. The results demonstrate that persistence does not significantly contribute to the variance in CMDI scores accounted for by the peg board and pink form board tasks. However, the inclusion of persistence in the model controlling for scores on the blue form board results in a 17% ($p<.05$) increase in the variance in CMDI scores accounted for by the blue form board. (See Table 4.)

Conclusions

The correlation analyses suggest that qualitative measures of persistence have a stronger association with overall competence and aspects of the child-rearing environment than do more quantitative aspects of persistence (e.g. attention span). Furthermore, maternal behavior, especially cognitive stimulation at home, appears to be a factor that needs more in depth elucidation in studies seeking to predict future and concurrent infant competence. The regression analyses suggest that when a task is too easy or is at the optimal level of challenge for a child, persistence does not significantly increase a child's ability to correctly solve the task, but when a task is very challenging or difficult persistence appears to facilitate a child's ability to achieve correct solution. The results from this study which demonstrate an important relationship between persistence and challenge in problem-solving tasks, indicate that one avenue for future research would be to examine persistence as a moderating variable between cognition and competence.

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Table 1
Zero-order Correlations Between Persistence, the Bayley Criterion Tasks, Non-Criterion Tasks, IBR Ratings, & Bayley CMDI

		1	2	3	4	5	6a	6b	7	8	9	10	11	12	13	14
1.	Persistence	—	.77**	.62**	.36*	.54**	.22	.02	.18	.11	-.30	.26	.13	.05	.49**	-.10
2.	Sum of Criterion Tasks (SCORE)	—	—	.65**	.63**	.75**	.34@	.13	.39*	.17	-.39*	.58**	.23	.21	.77**	.60**
3.	Peg Board	—	—	—	.04	.38*	.43**	.24	.29	.31	-.39*	.27	.18	.11	.62**	.35@
4.	Blue Form Board	—	—	—	—	.17	.21	.02	.33@	.03	-.26	.48**	.23	.27	.27	-.16
5.	Pink Form Board	—	—	—	—	—	.07	.03	.18	.04	-.15	.42*	.06	.03	.61**	.11
6.	Non-Criterion Tasks:															
a.	Problem Solving Tasks (5)	—	—	—	—	—	—	.14	.30	.30	-.33@	.09	.20	.31	.31	-.24
b.	Non Problem-Solving Tasks (3)	—	—	—	—	—	—	—	.37*	.13	-.24	.24	.40*	.34@	.13	-.07
7.	Sum of four IBR Scales (IBR)	—	—	—	—	—	—	—	—	.75**	-.28	.74**	.91**	.50**	.31	-.34@
8.	Object Orientation	—	—	—	—	—	—	—	—	—	-.28	.36*	.71**	.11	.14	-.43*
9.	Novelty of Action[1]	—	—	—	—	—	—	—	—	—	—	-.30	-.19	-.07	-.16	.26
10.	Goal Directedness	—	—	—	—	—	—	—	—	—	—	—	.53**	.36*	.28	-.15
11.	Attention	—	—	—	—	—	—	—	—	—	—	—	—	.44**	.29	-.27
12.	Endurance	—	—	—	—	—	—	—	—	—	—	—	—	—	.11	-.16
13.	Bayley CMDI	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.27
14.	Bayley CPDI	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

@ .05> p <.10, *p < .05, **p < .01

[1] Scale number 10: Novelty of action with an object was not included in IBR because of its low correlations with the other items from the IBR temperament scales.

Table 2
Zero-order Correlations Between HOME Scales,Persistence, the Bayley Criterion Tasks, Non-Criterion Tasks, IBR Ratings, and CMDI

	HOME	Maternal Involvement	Verbal Responsiveness	Avoidance of Punishment	Organization	Play Materials	Stimulation
Persistence	.43*	.18	.37*	.50**	.03	.48**	.38*
Sum of Criterion Tasks (SCORE)	.42*	.25	.54**	.28	.04	.47**	.34@
Peg Board	.33@	.18	.31	.42	-.06	.39*	.53**
Blue Form Board	.21	.13	.32@	.09	-.01	.24	-.22
Pink Form Board	.32@	.21	.46**	.09	.16	.35*	.45**
Non-Criterion Tasks:							
1 Problem-Solving Tasks	.28	.12	.20	.27	.09	.28	.17
2. Non Problem-Solving Tasks	.19	.16	-.02	.31	-.03	.22	-.02
Sum of four IBR Scales (IBR)	.37*	.41*	.11	.26	.12	.28	.19
Object Orientation	.31	.28	-.03	.37*	.20	.14	.40*
Novelty of Object Action	-.28	-.19	-.22	-.37*	-.04	-.22	-.11
Goal Directedness	.27	.42*	.32@	.0005	-.08	.29	.07
Attention	.43*	.45*	.02	.36*	.15	.34@	.27
Endurance	.06	.04	.05	-.01	.09	.04	-.22
CMDI	.62**	.58**	.59**	.31	.23	.55**	.31
CPDI	-.08	.07	.06	-.23	-.16	.04	.01

@ .05> p <.10, *p < .05, **p < .01

Table 3
Hierarchical Regression Model Estimating the Variance of Bayley Outcome Variable Accounted for by Persistence, controlling for SCORE [a] and the Total HOME Score.

Outcome	Cum R.[b]	Cum R^2 [c]	Inc.R^2[d]
Bayley CMDI			
SCORE	.60	.36**	
SCORE + HOME	.73	.53**	.17**
SCORE + HOME + Persistence	.74	.55**	.02 n.s.

Table 4.
Hierarchical Regression Models Estimating CMDI from Persistence, Peg Board, Blue Form Board, and Pink Form Board Scores.

Outcome	Cum R.	Cum. R^2	Inc. R^2
Bayley CMDI			
Peg Board	.35	.12@	
+ Persistence	.49	.24*	.12 n.s.
Blue Form Board	.26	.07 n. s.	
+ Persistence	.49	.24*	.17*
Pink Form Board	.61	.37**	
+ Persistence	.62	.38**	.01 n. s.

Note: @ $p < .10$, * $p<.05$, ** $p<.01$, n. s. = non significant
[a] SCORE is the sum of the Bayley scores given for the three Criterion Tasks (peg board, pink form board, and blue form board).
[b] Cum R. = Cumulative R
[c] Cum R^2 = Cumulative R^2
[d] Inc. R^2 = Increment in R^2 {squared semi-partial correlation coefficient : sequential}